Identified particle elliptic flow in Au+Au collisions at $\sqrt{s_{NN}} = 130$ GeV

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The collective expansion of the system created during a heavy-ion collision implies a characteristic mass dependence for the measured elliptic flow. We report the first result on elliptic flow for identified pions and protons + anti-protons.

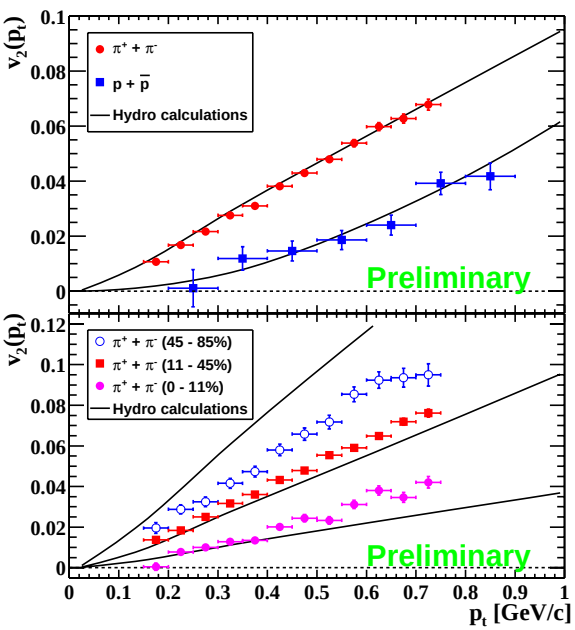

Figure 1: The upper panel shows the measured elliptic flow as a function of p_t intergrated over all centralities [1], for pions (the filled circels) and for protons + anti-protons (the filled squares). The lines correspond to hydrodynamical model predictions [2]. The lower panel shows the measured pion elliptic flow as a function of p_t for different centralities. The lines again correspond to hydrodynamical model predictions [2].

The pions and protons + anti-protons were selected according to their specific energy loss (dE/dx) in the STAR TPC up to a momentum of 0.75 GeV/c and 0.9 GeV/c respectively. The particle yields were obtained by fitting the dE/dx distributions with a multiple gaussian fit for each y, p_t bin and requiring a 90% purity.

The upper panel of Fig. 1 shows the measured elliptic flow (v_2) intergrated over all centralities, for pions and protons + anti-protons. The pions exhibit an almost linear dependence of $v_2(p_t)$. The protons + anti-protons however, show a more quadratic behavior of $v_2(p_t)$. From this figure it also is clear that the protons + anti-protons have a smaller v_2 at a fixed p_t than the pions. The solid lines show the predictions from hydrodynamical calculations [2] which shows the effect of collective expansion on $v_2(p_t)$ for different mass particles. From this comparison we can interpret the observed $v_2(p_t)$ for the different particles as the observation of collective expansion of the created system.

The lower panel of Fig. 1 shows $v_2(p_t)$ for pions as a function of centrality. The solid lines again are hydrodynamical calculations [2]. The pion $v_2(p_t)$ for all three centralities shows an almost linear behavior. From the comparison with the hydro calculation we see that the most central (0 – 11%) and the mid-peripheral (11 – 45%) data can be described rather well by this model. The agreement indicates the presens of an early stage pressure gradient. However, the most peripheral data clearly deviates from the hydro predictions. This can be interpreted as a lower degree of thermalization during the early stage of the collisions for the most peripheral data.

References

[1] STAR Collaboration, K.H. Ackermann *et al.*, Phys. Rev. Lett. **86**, 402 (2001).

[2] P. Huovinen *et al.*, nucl-ph/0101136.